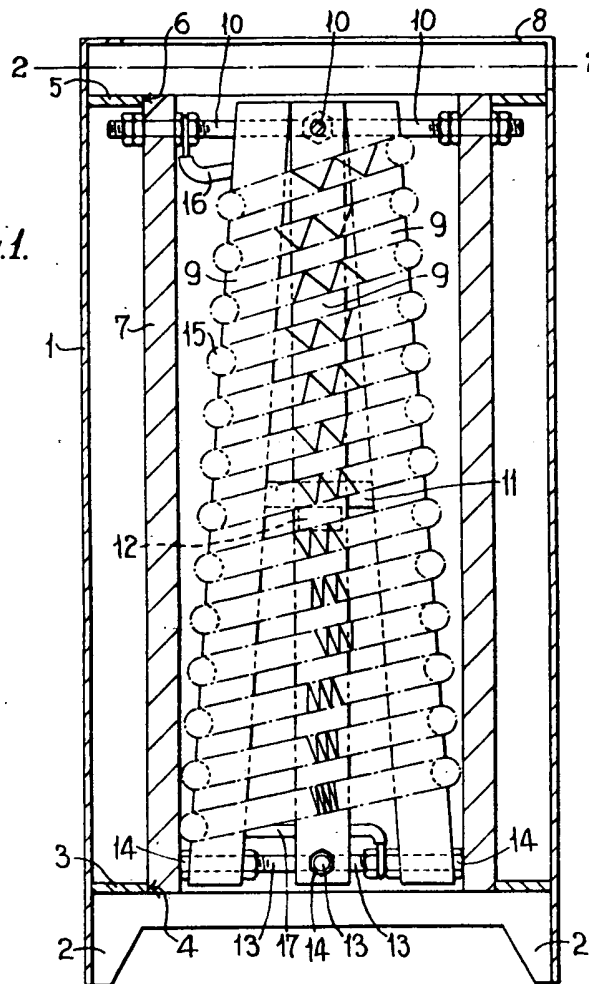


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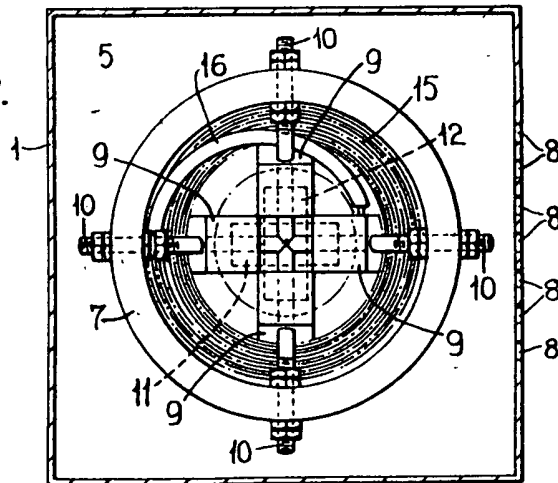
[This Drawing is a reproduction of the Original on a reduced scale.]

Fig.1.



375  
385

Fig.2.



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219 611

# PATENT SPECIFICATION



Application Date: Feb. 16, 1948.

Complete Specification Left: Feb. 15, 1949.

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No. 4110/48.

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## PROVISIONAL SPECIFICATION

### Improvements in or relating to Electric Heaters

We, AUSTIN MILLS LIMITED, of Austin Mills Limited's Factory, Lower Carrs, Stockport, in the County of Chester, a Company incorporated under the Laws of Great Britain, and THOMAS ARTHUR BEAVON, of M. & E. Services Limited, Wrexham, in the County of Denbigh, a Subject of the King of Great Britain and Northern Ireland, do hereby declare the nature of this invention to be as follows:—

This invention relates to that kind of electric heater wherein an electric heating element or elements are arranged in a housing to heat air as it is caused to flow through the housing.

An electric heater in accordance with our invention has an electric heating element or elements comprising a spiral of helically coiled resistance wire whose coils increase in pitch from that end which first comes into contact with air flowing from one end to the other of the spiral and which is wound on a framework tapering from the first named end and mounted inside a cylindrical casing so that the lower part of the spiral is closely surrounded by casing.

The casing or casings are so mounted within the housing that all the air entering the housing must flow through the casing or casings before it can escape from the housing.

The said framework may consist of heat-resistant and electrically insulating strips connected together at the ends and preferably stayed between the ends so as to form a skeleton framework and provided with notches to locate the spirally wound and helically coiled resistance wire.

In one construction we provide a housing which is open at the bottom and has feet or apertures so that air can flow freely into the housing at the lower end. The housing has a floor provided with any suitable number of circular apertures, for example two and in its upper part with a cross-partition provided with

registering apertures. A cylindrical tube of asbestos or other suitable heat resistant and preferably electrically non-conducting material is fitted in each aperture of the floor and the corresponding aperture of the partition so as to extend vertically upwards and form an air passage. The upper part of the housing has at its top and one side escape apertures for the air flowing through the passages. A baffle may be arranged in the upper part of the housing to guide the air leaving the passages to the outlet apertures. The floor is such that no air can pass from the lower end of the housing to the upper end thereof without flowing through the passages.

Each tube contains an electric heating element consisting of four strips of asbestos or other suitable heat resisting and electrically non-conducting material which are uniformly spaced apart circularly, extend from the lower end of the tube to the upper end and converge towards one another from the lower end to the upper end in pyramidal-like manner and have their upper ends connected to the tube, the axis of the pyramid coincides with the axis of the tube.

At suitable points between the ends of the strips, internal stays may be provided to prevent the strips from collapsing or bending inwards towards the said axis. To allow for expansion the means provided for connecting the lower ends of the strips together may be arranged longitudinally slidable on the inner wall of the tube so that they co-operate with the wall to keep the framework composed of the said strips and connecting rods concentric with the tube whilst leaving the framework free to expand and contract longitudinally independently of the tube.

The outer sides of the strips are provided with uniformly spaced notches, the notches of each strip being however displaced vertically relative to the

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notches of the other strip. One end of a helically coiled resistance wire whose resistance is such that in use it becomes heated without becoming incandescent is attached to the lower end of the framework and wound round it to engage the notches so that the notches cause the helically coiled wire to lie in open spirals from the lower end to the upper end of the framework. The upper end of the helically coiled wire is attached to the upper end of the framework. The two ends of the helically coiled wire are adapted to have electric current of suitable voltage connected to them.

The pitch of the helices of the resistance wire increases from the lower end of the framework to the upper end thereof so that the transfer of heat to the air flowing through the tube is evened out, notwithstanding the fact that the temperature of the air leaving the tube at the upper end is higher than its temperature when entering the tube at the lower end. By evening out the transfer of heat the temperature of the resistance wire is maintained more uniformly throughout its length and glowing of the resistance wire at or near the upper end of the tube is rendered less likely.

Due to the pyramidal-like form of the framework, the spirals of the helically coiled wire on the framework diminish successively in diameter from the lower

end upwards. This reduction reduces the masking of one part of the element from another from the air flowing through tube. Because the framework is of skeleton form there is a reduction of the restriction of air flow due to the support on which the resistance wire is wound, and therefore a satisfactory flow of air through the tube by convection is possible and no other means of producing an air draught is necessary.

In an alternative the helically coiled resistance wire may be wound on the framework in double spiral form so that both its ends are situated at the upper end of the framework, in which case the helical wind of the resistance wire increases in pitch from the centre outwards so that the pitch of each of the double helical spirals increases from the lower end of the framework upwards.

The housing may be provided with a pilot light to indicate that the heater is in action. It may also be provided with one or more kick switches to control the element or elements in such a manner that when the switch or switches are operated, the loading or output of the electric heater is controlled.

Dated this 14th day of February, 1948.

For the Applicants:

F. BOSSHARDT,

Chartered Patent Agent.

## COMPLETE SPECIFICATION

### Improvements in or relating to Electric Heaters

We, AUSTIN MILLS LIMITED, of Austin Mills Limited's Factory, Lower Carrs, Stockport, in the County of Chester, a Company incorporated under the Laws of Great Britain, and THOMAS ARTHUR BEAVON, of M. & E. Services Limited, Wrexham, in the County of Denbigh, a Subject of the King of Great Britain and Northern Ireland, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to that kind of electric heater wherein an upstanding helix of helically coiled resistance wire mounted on a framework both tapering from the lower end to the upper end are arranged in a casing to heat air as it is caused to flow through the casing.

An electric heater of the hereinbefore specified kind in accordance with our invention has the coils of its helically coiled resistance wire increasing in pitch from the lower end to the upper end of the wire, the lower part of the wire being

closely surrounded by the casing.

There may be one or more resistance wires and one or more casings, the casing or casings being so mounted within a housing that all the air entering the housing must flow through the casing or casings before it can escape from the housing.

The casing or casings are preferably electrically insulating and heat resistant. The said framework may consist of heat-resistant and electrically insulating strips connected together at the ends and preferably stayed between the ends.

The framework may be connected to the casing at its upper end and unconnected but laterally supported by the casing at its lower end.

In order that our invention may be fully understood and more readily carried into practice, we have caused to be appended hereunto drawings illustrating diagrammatically a constructional example thereof, wherein:—

Figure 1 is a side view in section of an electric heater.

Figure 2 is a plan view in section taken on a line corresponding with line 2—2 of Figure 1.

Referring to the drawing, in the construction shown therein we provide a housing 1 which is open at the bottom and has feet 2 or apertures so that air can flow freely into the housing at the lower end. The housing 1 has a floor 3 provided with a circular aperture 4 and in its upper part has a cross-partition 5 with a registering aperture 6.

A cylindrical tube 7 of asbestos or other suitable heat resistant and electrically non-conducting material is fitted in the aperture 4 of the floor 3 and the aperture 6 of the partition 5 so as to extend vertically upwards and form an air passage. The upper part of the housing has at its top and on one side escape apertures 8 for the air flowing through the tube 7 passage. A baffle may be arranged in the upper part of the housing 1 to distribute the air leaving the tube 7 to the outlet apertures 8. The floor 3 is such that no air can pass from the lower end of the housing 1 to the upper end thereof without flowing through the tube 7.

The tube 7 constitutes a casing containing an electric heating element consisting of four strips 9 of asbestos or other suitable heat resisting and electrically non-conducting material which are uniformly spaced apart circularly, extend from near the lower end of the tube 7 to near the upper end and converge towards one another from the lower end to the upper end in pyramidal manner and have their upper ends connected to the tube 7 by connected rods 10. The axis of the pyramid coincides with the axis of the tube 7.

At suitable points between the ends of the strips 9 internal stays 11 and 12 may be provided to prevent the strips 9 from collapsing or bending inwards towards the said axis. To allow for expansion joined rods 13 and nuts 14 provided for connecting the lower ends of the strips 9 together are arranged longitudinally slidable on the inner wall of the tube 7 so that they co-operate with the wall to keep the framework composed of the said strips and connecting rods concentric with the tube 7 whilst leaving the framework free to expand and contract longitudinally independently of the tube 7.

The outer sides of the strips 9 are provided with uniformly spaced notches, the notches of each strip being however displaced vertically relative to the notches of the other strip. One end of a helically coiled resistance wire 15 whose resistance is such that in use it becomes heated without becoming incandescent is

attached to the lower end of the framework and wound round it to engage the notches so that the notches cause the helically coiled wire to lie in open spirals from the lower end to the upper end of the framework. The upper end of the helically coiled wire is attached to the upper end of the framework. The upper end of the helically coiled wire has a conducting wire 16 connected to it and the lower end has a conducting wire 17 connected to it whereby electric current of suitable voltage can be connected to them.

The pitch of the helices or coils of the resistance wire 15 increases from the lower end to the upper end for example as indicated diagrammatically in the drawing so that the transfer of heat to the air flowing through the tube 7 is evened out, notwithstanding the fact that the temperature of the air leaving the tube 7 at its upper end is higher than its temperature when entering the tube at its lower end. By the evening out of the transfer of heat the temperature of the resistance wire 15 is maintained more uniformly throughout its length and glowing of the resistance wire 15 at or near the upper end of the tube is thereby rendered less likely.

Due to the pyramidal-like arrangement of the strips 9 the spirals of the helically coiled wire 15 on the strips diminish successively in diameter from the lower end upwards. This reduction reduces the masking of one part of the element from another from the air flowing upwards by connection through tubes 7. Because the support for the resistance wire 15 is of skeleton form there is a reduction of the restriction of air flow due to the support on which the resistance wire is wound, and therefore a satisfactory flow of air through the tube by convection is possible and no other means of producing an air draught is necessary.

In an alternative the helically coiled resistance wire may be wound on the framework in double spiral form so that both its ends are situated at the upper end of the framework, in which case the helical windings of the resistance wire increase in pitch from the centre outwards so that the pitch of each of the double helical spirals increases from the lower end of the framework upwards.

For an electric heater of larger capacity there may be two tubes arranged side by side in the casing and each furnished with an electric heating element of the hereinbefore described construction, the tubes extending through holes in the floor and cross-partition of the housing.

The housing may be provided with a pilot light to indicate that the heater is in action. It may also be provided with one or more kick switches to control the element or elements in such a manner that when the switch or switches are operated, the loading or output of the electric heater is controlled.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. An electric heater of the specified kind, having the coils of its helically coiled resistance wire increasing in pitch from the lower end to the upper end of the wire, the lower part of the wire being closely surrounded by a casing.

2. An electric heater according to claim 1, wherein there is one or more resistance wires and one or more casings, the casing or casings being mounted within a housing so that all the air entering the hous-

ing must flow through the casing or casings before it can escape from the housing.

3. An electric heater according to either of claims 1 and 2 claims, wherein the said framework consists of heat-resistant and electrically insulating strips connected together at the ends and preferably between the ends.

4. An electric heater according to any of the preceding claims, wherein the framework is connected to the casing at its upper end and is unconnected to but laterally supported by the said casing at its lower end.

5. An electric heater substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 12th day of February, 1949.

For the Applicants:

F. BOSSHARDT,

Chartered Patent Agent,

31, Regent House, Cannon Street,  
Manchester, 4.

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